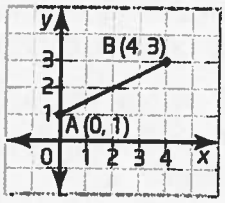
Communicate Your Understanding



C1 Describe how you can find the length of the line segment joining the points A(0, 1) and B(4, 3).

C2 When you use the formula for the length of a line segment, does it matter which point is represented by (x_1, y_1) and which point is represented by (x_2, y_2)? Use an example to explain your reasoning.

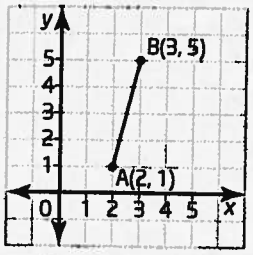
C3 Explain why the expression $(x_2 - x_1)^2 + (y_2 - y_1)^2$ never has a negative value.

Practise

For help with questions 1 to 3, see Examples 1 to 3.

1. Estimate the length of each line segment from its graph. Then, calculate the exact length.

a)



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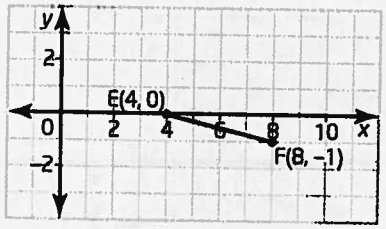

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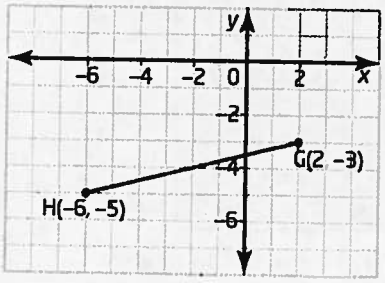


2. Calculate the length of the line segment defined by each pair of endpoints.

a) A(−6, −2) and B(4, 3)

b) C(−2, 0) and D(7, −3)

c) E(−5, −6) and F(−1, −2)

d) G(0, 5) and H(8, −1)

3. Calculate the length of the line segment defined by each pair of endpoints.

a) J(2.1, 8.3) and K(−4.5, −4.7)

b) L(−4.2, −5.1) and M(11.6, 9.2)

c) $N\left(\frac{1}{2}, \frac{5}{2}\right)$ and $P\left(\frac{3}{2}, -\frac{5}{2}\right)$

Connect and Apply

4. On a city map, the coordinates of two department stores are (4, 3) and (1, 7). How far apart are the stores if each unit on the map represents 1 km?

5. On a street map of his town, Jordan's house has coordinates (8, 1). The town's two high schools are at (0, 5) and (6, 11).

a) Which school is closer to Jordan's house?

b) Describe a method you could use to check your answer to part a).

6. The vertices of $\triangle ABC$ are A(2, 5), B(−6, −1), and C(10, −1).

a) Determine the length of each side of this triangle.

b) Determine the perimeter of the triangle.

c) Classify the triangle.

7. a) Show that the triangle with vertices D(−1, 0), E(1, 0), and $F(0, \sqrt{3})$ is equilateral.

b) List the coordinates of the vertices of another equilateral triangle.

8. Determine the length of the median from vertex J in the triangle with vertices J(−2, −2), K(−3, 2), and L(1, 3).

9. **Use Technology** Use *The Geometer's Sketchpad®* or Cabri® Jr. to verify your answer to question 8.

10. Determine the area of the right triangle with vertices R(4, 4), S(−2, −2), and T(10, −2).

11. **Use Technology** Use *The Geometer's Sketchpad®* or Cabri® Jr. to verify your answer to question 10.

12. Use the length formula to verify that C(−5, −1) is the midpoint of the line segment joining A(−2, 5) and B(−8, −7).

13. A line segment has endpoints K(−2, 7) and L(4, −2).
    a) Find the coordinates of the midpoint of this line segment.
    b) Use the length formula to verify your answer to part a).

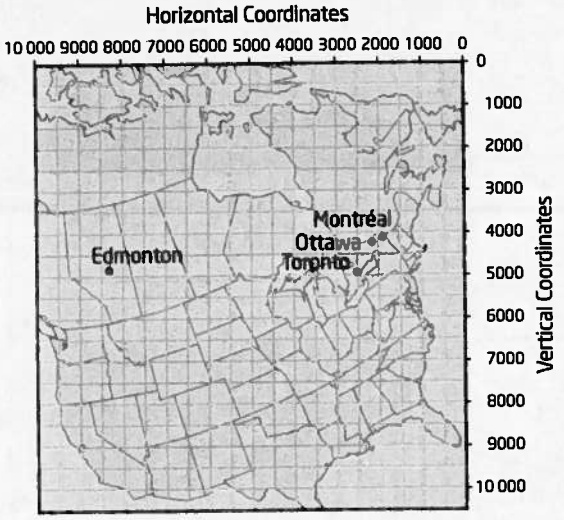
14. An architect's drawing shows a pipe running diagonally under a basement floor from a floor drain to a sewer connection. The floor drain is at a point 2 m east and 2 m north of the southwest corner of the basement. The sewer connection is 10 m east and 17 m north of the corner. The pipe costs $3.15 per metre, including taxes. How much should the builder budget for pipe for the floor drain?

15. a) Draw a triangle with vertices P(−3, −4), Q(5, 1), and R(2, 7).
    b) Determine the coordinates of the midpoints of PQ and PR. Label these midpoints S and T.
    c) Show that ST is half the length of QR.
    d) Show that ST is parallel to QR.
    e) Show that the triangle formed by joining the midpoints of the sides of △PQR is similar to △PQR.

16. **Use Technology** Use *The Geometer's Sketchpad®* or Cabri® Jr. to verify your answer to question 15.

17. The charges for most long-distance telephone calls used to be based on the distance between the two stations and the duration of the call. To determine the distance, telephone companies used a rectangular coordinate grid with its origin located off the northeast coast of Canada. The coordinates in this system indicate the horizontal and vertical distance from the grid's origin. This table lists the telephone coordinates, converted to kilometres, for four cities.

City	Coordinates
Edmonton	(3978, 2520)
Montréal	(1015, 2104)
Ottawa	(1142, 2232)
Toronto	(1268, 2540)



    a) Calculate the distance, to the nearest kilometre, between Edmonton and Ottawa, between Montréal and Toront and between Edmonton and Toronto.
    b) Research the flying distances between these cities. How accurate is the telephone coordinate system?